In most envisioned wildland firefighting techniques where a drone carries a nozzle and hose that extends to the water source, the drone pulls the hose along with it as it flies toward the fire, or flies along the fire perimeter applying water to the fire.

It would generally require too much force to pull the hose along the ground, or on vegetation above the ground, especially since doing so would likely result in the hose or connections getting stuck in the vegetation. For this reason, the hose is suspended in the air and moves along with the drone. But this presents its own problem.

Since the hose is flexible, it would sag in the center forming a long shallow U shape called a catenary. Here the principle of mechanical advantage/disadvantage becomes a factor in the drones ability to carry the hose.

Downward movement in the center of the hose (creating the sag) causes inward movement at one or both ends of the hose. These movements or displacements are unequal in distance The depth of the sag is greater than the total of the inward displacements at one or both ends. As a result the force pulling the drone downward and rearward is considerably greater than the weight of the water filled fire hose itself. In other words, leverage is working against the drone (mechanical disadvantage). The further out the drone flies, the greater this force becomes.

To address this limitation, it has been proposed that other drones take positions at spaced intervals along the hose to help support it. As the lead drone with the nozzle moves forward, all of these other drones move with it in tandem. As the lead drone continues to move forward, more and more drones are added to help carry the hose.

At the water source, the hose being let out could be hard line hose coming off of a hose reel, or alternately flat canvas hose.

The present idea envisions a different approach where only two drones working together can extend a hose a very long distance, while applying water to a fire, without the drones being subjected to increasing forces working against them as they move forward. As proposed here, the drone carries the hose reel, and the water or other fire retardant moves through the hose in the opposite direction than when the hose reel is used conventionally. That is, the end of the hose where the nozzle is intended to be attached is now connected to the water source, and a short inlet hose (also called a feeder hose or supply hose) that conventionally feeds water into the center axis of the reel now carries the nozzle at its end, and water is fed to it from the center axis of the reel after it has passed through the long hard line hose.

The nozzle at the end of the short inlet hose is mounted with a two-axis connection that can be aimed at the fire remotely, and would have a remotely controlled adjustable spray pattern. A video camera is mounded with a two or three-axis connection (standard with drones), enabling the drone pilot or mate to apply water or retardant onto the fire as the drone flies along the fire perimeter.

As the drone moves forward, the hose could merely unwind passively from the reel and lay on the ground, or alternately, the unwinding could be assisted with a motor which could turn the reel in either direction. Turning the reel as to wind it up would enable the drone to go in reverse to extinguish flare-

ups. Once on the ground or vegetation above the ground, the hose stays put. It is not pulled by the drone.

Ideally the hose unwinds from the reel in such a way that, if the drone is moving in front of us from our right to our left, the reel would be rotating in a counterclockwise direction from our perspective. In other words, the hose would be coming off the front of the reel rather than back.

When the drone reaches the end of the hose, the hose is remotely decoupled from the reel (by means described below) and falls to the ground. The second drone, which is fitted like the first, takes position and dangles the end portion of its hose above the end of the first drones' hose (which is now on the ground) and a firefighter following on foot couples the two hoses together. The second drone, now being connected to the water source, continues along the fire perimeter where the first drone left off. Meanwhile, the first drone is flown back to where operations are being conducted to be fitted with a new hose, and the process is repeated again and again.

In order to prevent dirt from entering the end of the hose when it falls to the ground, a fabric sleeve could cover the hose coupling and extend several inches in either direction. The sleeve would be connected to the hard line hose, but it would not prevent it from falling once the hose is decoupled. Alternately, this could be accomplished with a spring loaded flap that is held open by the female component of the coupling when coupled with the male component, but which would spring closed covering the opening of the male component when they are decoupled.

At the drum of the reel (the cylindrical member in the center of the reel), either on the inside or outside of the drum, there is a pipe fitting called a gooseneck which couples with the end of the hard line hose. At this gooseneck, or alternately, at the end of a several inch long hose connected to the gooseneck, the female component of a quick connect coupling is attached, while the male component is attached to the end of the hard line hose. The quick connect coupling is similar to the type used on garden hoses. To decouple the hose from the reel, a collar on the female side of the quick connect coupling is pulled back. To accomplish this remotely, the collar is pulled back with a remotely activated solenoid or actuator. If it desired that the firefighter decouple the hose by hand so as not to let it fall freely, then a hose of approx. 30-60 feet in length would couple with the gooseneck at one end and the main hard line hose at the other. The firefighter would then decouple the main hose from the shorter one by hand while the drone hovers above.

With booster pumps placed at intervals, the hose could be extended for thousands of feet by using only two drones. Most importantly, the drones would never have to lift any more weight, or overcome any force greater than the weight of the hose reel, the water filled hose on the reel, and the other onboard apparatus.

A possibility to be explored would be to have a "T" connection at the juncture of the hoses for later mop up operations by ground crews, or for flare-ups.

The coupling of the hoses at the drone exchange site might, with further advancements, also employ remote operation technology, but that is beyond the scope of this disclosure. Presently, the method proposed would be limited to conditions where it was safe for a firefighter to walk along the perimeter of the fire as it is being extinguished by the drone. It is noted that if conditions are safe enough for a conventional hose lay along the fire's perimeter (a much slower process that the present), then it would likely not be too hazardous for a firefighter to follow the drones on foot.

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